SUPPORT FOR THE AMENDMENT

This Amendment cancels Claims 9 and 15; and amends Claims 8, 10, 14 and 16. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claims 8 and 14 is found in canceled Claims 9 and 15, respectively; and support for "Cr in an amount of more than 5 atomic % and less than or equal to 10 atomic %" is implicit in the specification at least at page 17, lines 20-21 ("5 to 10 atomic % of one or more kinds selected from Cr and V"). No new matter would be introduced by entry of these amendments. Upon entry of these amendments, Claims 8, 10-12, 14, and 16-17 will be pending in this application. Claims 8 and 14 are independent.

REQUEST FOR RECONSIDERATION

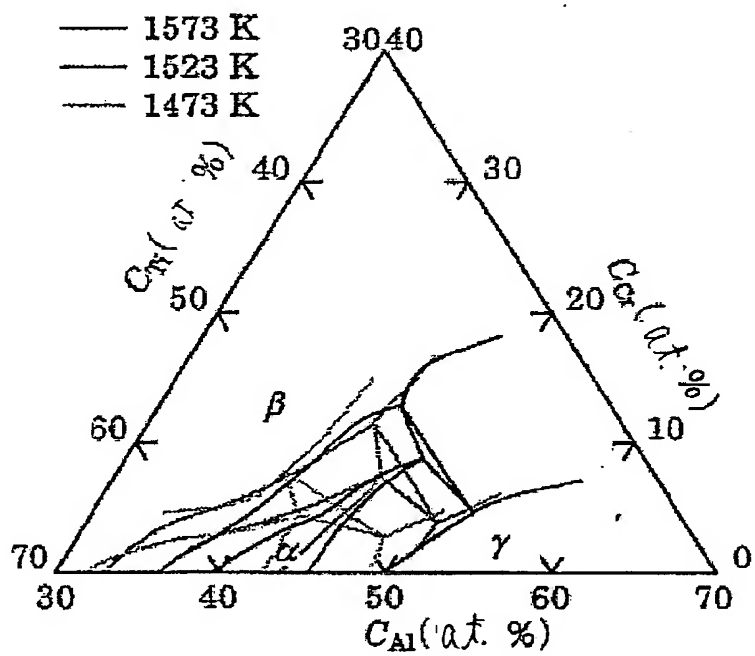
Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

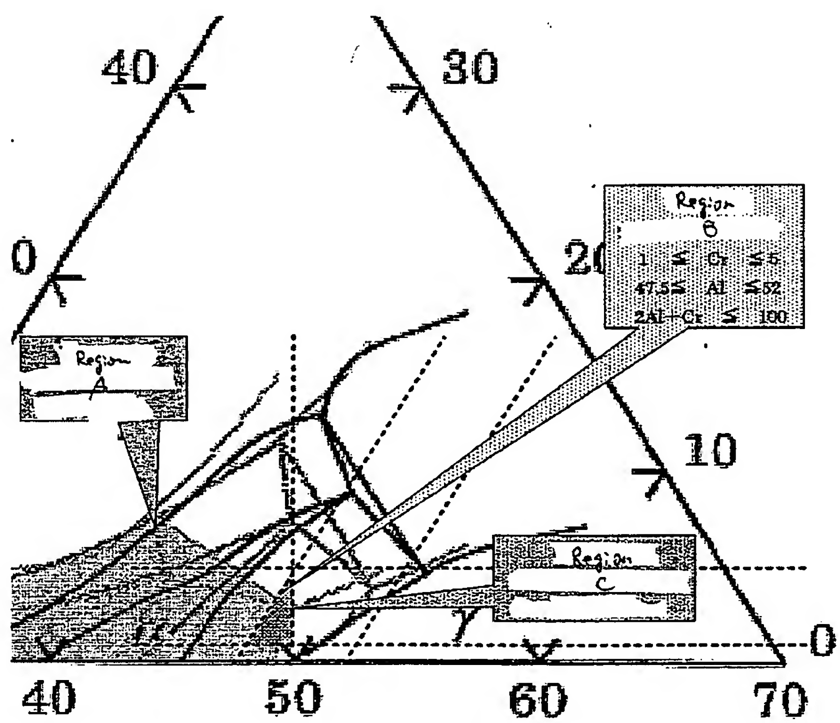
The present invention provides a method of producing a high strength TiAl based alloy having a microstructure in which lamellar grains having a mean grain diameter of from 1 to 50 μm are closely arranged. Specification at page 3, lines 15-17; abstract. To reduce the mean grain diameter of the lamellar structure, the TiAl based alloy material is held in an equilibrium temperature range of an α phase or in an equilibrium temperature range of an (α+β) phase, and then the material is subjected to high-speed plastic working in the cooling process thereafter. Specification at page 3, line 24 to page 4, line 3.

Claims 8-12 and 14-17 are rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,370,839 ("Masahashi").

The production method of the present invention results in the formation of lamellar structure, while the production method of Masahashi does not. This is due to the difference in Cr concentration in the alloys and the difference in the procession temperatures.

Shown below are a phase diagram of a TiAl based alloy in a ternary system (Ti-Al-Cr), and an enlarged version thereof. In these diagrams, Al concentration (30-70 atomic %) in the ternary system alloy is shown at the bottom, while Cr and Ti concentrations are shown on the right and left sides of the diagrams, respectively.





The gray area, "Region A", corresponds to the α phase at 1473°C or lower. The alloy of Masahashi is in "Region B" (shown as a parallelogram with dotted lines, which is the region defined by 47.5 $\leq$ Al $\leq$ 52, and 1 $\leq$ Cr $\leq$ 5). Most of the Region B is outside of the α phase (gray area). The dotted area, "Region "C", is part of the α phase, which is overlapped with the Region B. However, as the (homogenizing) temperature is lowered from 1473K, the boundary of the α phase shifts to the lower left of the diagram, resulting in shrinkage of the overlapped region (Region C), and eventually the region disappears. In the production method of Masahashi, the homogenization heating is performed at the temperature between 1272K to solidus temperature. Actually, Masahashi operates the homogenization treatment at 1323K (1050°C), which is much lower than the lowest temperature in the above-shown diagram (1473K) and the lowest temperature recited in Claim 14 (1423K) (see Table 2-1 of Masahashi for the homogenizing temperature). At this low operation temperature of 1323K (1050°C), the alloy of Masahashi is in the γ+β phase, not in the α phase (see specification at Fig. 4), therefore no lamellar structure can be formed by the method of Masahashi.

In relation to whether or not the overlapped region disappears when the homogenizing temperature is lowered, Masahashi discloses:

> When chromium is used as the third alloying element, as revealed by the inventors, β phase is formed in α_2 phase of the initial lamellar structure in the melting process. Therefore, thermomechanical recrystallization is not necessarily essential for the forming of β phase. Therefore, the temperature is between 1173 K and the solidus temperature, in which range γ phase is recrystallized. Masahashi at column 6, lines 5-12.

This means that Masahashi utilizes recrystallization instead of lamellar structure for producing an alloy with the preferred properties, even if the lamellar structure initially exists in the material. In Masahashi, the presence of the lamellar structure prevents efficient super-plastic working which follows the melting process. Therefore, the homogenizing treatment is conducted at the temperature region of (γ+β) phase. Although Masahashi does not exclude

the possibility of conducting the super-plastic working at higher temperature, which may be in the range of α phase, the cooling speed of Masahashi is too slow for the lamellar structure to be formed in the alloy.

In contrast to this, the method of the present invention includes the step of homogenizing the alloy at the α phase temperature, 1503K (1230°C) to 1673K (1400°C), or (α+β) phase temperature, 1423K (1150°C) to 1573K (1300(°C), which enables the formation of the lamellar structure when the thermomechanical treatment is conducted after the homogenizing treatment. The homogenizing temperature is now clearly recited in the claims in combination with thermoechanical treatment and chromium concentration.

Furthermore, Masahashi does not even try to form the lamellar structure. Instead of trying to form the lamellar structure, Masahashi utilizes recrytallization (see column 3, lines 60-68). In column 4, lines 13-16, Masahashi states "[p]recipitation of β phase at γ grain boundaries is absolutely necessary ...", which is not necessary in the present invention.

The invention of Masahashi is related to isothermal forging, while the present invention is related to high-speed plastic working (hot working). Because of this difference, the person having ordinary skill in the art would not be motivated to combine the operation conditions of Masahashi with those of the present invention to produce the TiAl based alloy. Specifically, Masahashi used conditions as follows:

Distortion Speed: 10^{-4} /s (Low Distortion Speed)

Initial Temperature: 1473K (1200°C)

Working Ratio: 60%

If the lowest cooling rate of the present invention, 50°C/min, is employed with the above-listed conditions of Masahashi, it requires 6000 seconds (=0.6/0.0001) (= 100 minutes) to complete the production of the TiAl based alloy. However, since the production is initiated at 1473K (1200°C), the temperature range drops to one lower than room temperature

in just 24 minutes, which makes it impossible to complete the whole process. Accordingly, Masahashi is inappropriate for rejecting the present claims.

Thus, the rejection over Masahashi should be withdrawn.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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